

Responses for NODY-D-21-02564:
Dynamics of Physical Autonomous Robotic Network with Constant and Time-Varying Communication Delays
Journal: *Nonlinear Dynamics*.

The authors would like to convey their deepest appreciation for the thorough efforts made by the reviewers and the technical editor. The comments clearly demonstrate their sound expertise, and are extremely constructive and helpful for us to improve the quality and presentation of the paper. In the revised version, we have addressed all the comments and concerns.

Reviewer 1 :

In this paper, the authors attempted to study the dynamics of physical autonomous robotic network with constant and time-varying communication delays. Generally speaking, the structure of this article is not clear, and the article has a lot of grammatical and spelling errors. In addition, the proofs of lemmas and theorems are not explained clear in the whole process of this paper, which makes the reviewer is highly skeptical of the correctness of the conclusions. The main contributions laid out in this article may not seem obvious. Therefore, the reviewer believes that the article is not suitable for future publication. In the following, the reviewer just lists some of the critical errors

- **Comment 1-R1:** *The authors declare that the time-varying delay is addressed well, but, in fact, there shows that the different time-varying delay is assumed to be the same one ($\epsilon_{i,j}(t) = \epsilon(t)$) in Section 3. In addition, equation (10) indicates that the time-varying delay is a constant in nature. I don't know what is really innovation about this article.*

Response: First, we provided a model with different time-varying delays, then for the analysis, we assumed they are the same due to the complexity of studying the stability with different time-varying delays. To study the effect of time-varying delay, we took the average of it (i.e. constant delay) and studied the stability in this case. In the numerical simulation, we compared the two situations (time-varying delay and constant delay).

- **Comment 1-R2:** *Where does the key Lemma 4.1 come from? It should be proved.*

Response: Lemma 4.1 determines the stability when there is no time delay, so we can study how the delay affects the system dynamics. The proof is provided before Lemma 4.1, which is straightforward from Eq(24) and Eq(25) by using the Routh-Hurwitz stability criterion.

- **Comment 1-R3:** *The logic of Theorem 4.1 is unclear and should be carefully revised.*

Response: Theorem 4.1 presents the critical value ϵ^* of the constant time delay which gives the value of time delay at which the system loses or gains stability.

- **Comment 1-R4:** *There are still many symbols that need to be explained when they are first introduced, such as $\tilde{v}_0, \tilde{v}_i, X(\cdot)$..*

Response: The tilde symbol “~” is related to the perturbations about the flow equilibrium which is already defined before Eq(6) as $\tilde{\mathbf{X}}_i = [\tilde{s}_i(t), \tilde{v}_i(t)]^T = [s_i(t), v_i(t)]^T - [s_i^*, v^*]^T$.

- **Comment 1-R5:** *There are many symbol typos, for example, $X_i(t)$ should be $\tilde{X}_i(t)$. Please carefully check the whole article and revise them.*

Response: They are the same, the tilde symbol was not in the middle, over $\mathbf{X}$, in some of them as $\mathbf{X}_i(t)$. We have fixed them to be consistent and have the form $\tilde{\mathbf{X}}_i(t)$.

- **Comment 1-R6:** *The tense of the article is very confusing, with past and present tense jumping around.*

Response: We thank the reviewer for the comment and the carefulness. We have updated the text to have consistent tense throughout the paper.

- **Comment 1-R7:** *More explanations should be given to the transfer function $F_{i,j}$.*

Response: We have changed $F_{i,j}$ to $T_{i,j}$ to be consistent with the numerical simulation. We already provided an example in Fig. 8. The derivation of this transfer function is given in Reference [35] of the revised manuscript.

- **Comment 1-R8:** *There are lots of syntax errors and inappropriate expressions in this paper. For example, in the middle Page 9, ' $b_i >$ '; in Theorem 4.1, 'assumed (26) is satisfied such that...', just to name a few. The authors should check the paper carefully to avoid possible grammatical mistakes.*

Response: We have checked the paper carefully.

Reviewer 2 (R2):

The work is interesting and has a good contribution to the research of the CAVN. However, in addition to some errors in expression, the authors also made some assumptions, approximations and linearization, which require the author to modify and make reasonable explanations. The following are some comments on improving the quality of the manuscript:

- **Comments 1-11-R2:**

- The authors should check the citation format of the references in the manuscript according to the submission guidelines of "Nonlinear Dynamics". For example, in paragraph 1, line 6 of Introduction: [1, 2, 3]. Paragraph 2, line 16: [8], [9], [10]...
- *In line 2 on page 2, the authors said "in system design", which system does this refer to specifically? If it is the CAVN system, whether it should specifically specify the CAVN system. The authors should also check for similar expressions.*
- *The authors also, in several places, use "we", which might not be appropriate.*
- *In line 6 on page 2, "or" in "naturally occurring, or alternatively induced" should be "and".*
- *On page 2, line 13, "For example,.....", the authors need to check whether the citation format of the references is correct, and the expression of this place is beyond my understanding. And there should be ", "after [14].*
- *On page 2, paragraph 1, line 16, it should not be "was" but "were". Similarly, the authors should carefully check where the singular form should be used and where the plural form should be used. For example: on page 2, paragraph 1, line 17, whether or not "has" should be used in this place.*
- *On page 2, paragraph 2, line 1, I think "addressed" and "considered" should be used; in line 4 of this paragraph, "was" should be used. Moreover, the authors should check whether the tenses in the manuscript are used correctly.*
On page 2, paragraph 2, line 6, it should be "the stability".
- *At the end of page 2, it should be "Section 2" instead of "Sections 2". To be precise, according to the style of "Nonlinear Dynamics", this should be "in Sect. 2".*
- *In Section 2, paragraph 2, if " s_i " is position, why is " v_i " velocities? The authors need to check the accuracy of the singular or plural nouns here and elsewhere.*
- *In the paragraph after Figure 1, I don't understand what "in the literature" refers to.*

Response: We highly appreciate the efforts and the carefulness of the reviewer. We have updated based on the comments. Thanks.

- **Comment 2-R12:** *The authors have adopted many linearization and approximation treatments in the manuscript. Please give reasonable explanations.*

Response: Thanks for the comment. Through the paper, we just have one linearization that is given in Eq(6). We used it to study the stability with time-varying delay in Eq(8) and with constant delay in Eq(21).